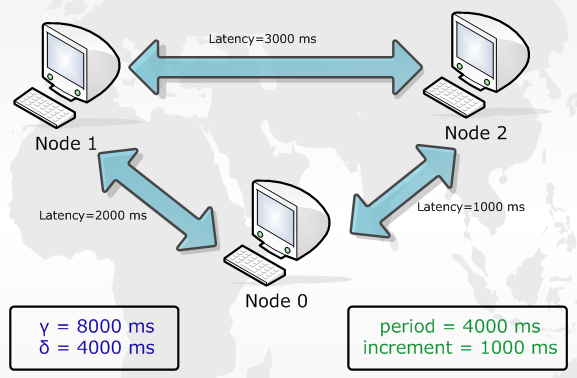
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| Software Engineering of Distributed Systems, KTH |
| Distributed Systems Advanced Homework 2 |
| Implementation of Perfect Failure Detector Component and Eventually Perfect Failure Detector Component |

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| Shanbo Li and Sike Huang  2/9/2008 |

# Exercise 1: Verify the completeness of the failure detectors

The topology is shown as following, three nodes are connected together, and each node has two links to the other two nodes respectively.



## 1.1 Experiment with Perfect Failure Detector Component

After system starts, every node works well. Each of them can receive heartbeat from others.

We manually crash *node 2* and the follows are the output of *node 1* and *node 0*:

**After Manually Crash Node 2**

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| Node 1: |
| Failure detected! Node 2 crash!  At 1202571867827  Duration since last heartbeat is 14859 ms  Gamma = 8000 ms  Delta = 4000 ms |

**After Manually Crash Node 2**

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| Node 0: |
| Failure detected! Node 2 crash!  At 1202571869686  Duration since last heartbeat is 18703 ms  Gamma = 8000 ms  Delta = 4000 ms |

From the log above, we can observe that each node is detecting others by receiving heartbeat. *Node 1* detects the duration since he received the *node 2*’s last heartbeat is 14859 ms, which is longer than γ + δ (12000 ms). So he detects that *node 2* crashed. And it is similar for *node 0*, he also detects that *node 2* crashed. The duration since node 0 gets *node 2*’s last heartbeat is 18703 ms which is also longer than 12000 ms.

Shortly after *node 2* crash, we manually crash *node 1*, and the follow log are from *node 0*’s output

**After Manually Crash Node 1**

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| Node 0: |
| Failure detected! Node 1 crash!  At 1202571893686  Duration since last heartbeat is 15859 ms  Gamma = 8000 ms  Delta = 4000 ms |

It shows that *node 1* failed to send out heartbeat every γ time, and *node 0* has not received heartbeat from *node 1* for 15859 ms. So it detects *node 1* crashed.

## 1.2 Experiment with Eventually Perfect Failure Detector Component

After system starts, every node works well. Each of them can receive heartbeat from others.

We manually crash *node 2* and the follows are the output of *node 1* and *node 0*:

**After Manually Crash Node 2**

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| Node 1: |
| Suspect "Node 2"!  At 1202575987905  Period = 5000 ms  Duration since last heartbeat is 8516 ms |

**After Manually Crash Node 2**

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| Node 0: |
| Suspect "Node 2"!  At 1202575985514  Period = 5000 ms  Duration since last heartbeat is 8125 ms |

From the log above, we can observe that each node is detecting others by receiving heartbeat. Node 1 suspect *node 2* because he has not received heartbeat from *node 2* for 8516 ms, which is longer than period which is 5000 ms. On node 0, it has not received heartbeat from *node 2* for 8125 ms which is also longer than period, so it will also suspect *node 2*.

Then we manually crash *node 1*, see what happens on *node 0*.

**After Manually Crash Node 2**

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| Node 0: |
| Suspect "Node 1"!  At 1202575995514  Period = 5000 ms  Duration since last heartbeat is 5609 ms |

*Node 0* suspect *node 1* for it has not received heartbeat from node 0 for 5609 ms. So *node 0* add *node 1* to its suspect list.